Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Federal-State Joint Board on	)	CC Docket No. 96-45
Universal Service	)	

COMMENTS OF QWEST COMMUNICATIONS INTERNATIONAL INC.
IN RESPONSE TO THE JOINT BOARD'S RECOMMENDED DECISION

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Qwest Communications International Inc. ("Qwest") respectfully submits these comments in response to the *Recommended Decision*[1] issued by the Federal-State Joint Board on Universal Service ("Joint Board") regarding the remand from the decision of the United States Court of Appeals for the Tenth Circuit in *Qwest Corp. v. FCC*, 258 F.3d 1191 (10th Cir. 2001). The *Recommended Decision* "essentially reaffirms" the existing support mechanism,[2] by "embrac[ing] a variety of flawed arguments that purport to justify continuation of the status quo."[3] In particular, the *Recommended Decision* disregards the court's central mandate to "induce adequate state action" to ensure reasonable comparability of rural and urban rates. As a result, the *Recommended Decision* must be rejected.

I. INTRODUCTION AND SUMMARY

In 1996, Congress enacted the Telecommunications Act of 1996, which requires the Federal Communications Commission ("Commission") to establish "specific, predictable and

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1 *See In the Matter of Federal-State Joint Board on Universal Service*, CC Docket No. 96-45, *Recommended Decision*, FCC 02J-2, rel. Oct. 16, 2002.

2 Statement of Commissioner Kevin J. Martin, Approving in Part, Dissenting in Part, as attached to the *Recommended Decision* at 1 ("Martin Statement").

3 *See* Separate Statement of Commissioner Bob Rowe, Montana Public Service Commission, Dissenting, as attached to the *Recommended Decision* at 1 ("Rowe Statement").

sufficient" federal mechanisms to preserve and advance universal service. If adopted, the *Recommended Decision* would move the Commission no closer to meeting this statutory objective. The Joint Board's proposal includes the same fundamental flaw that caused the Tenth Circuit to remand the *Ninth Report and Order*:[4] it "simply assume[s]" that the states will take actions necessary to ensure reasonable comparability within their borders.[5]

As pointed out by Commissioners Martin and Rowe, the majority's recommendation relies on two flawed assumptions. *First*, the *Recommended Decision* concludes that urban and rural rates are reasonably comparable today, so there is no need to modify the existing support mechanism. As explained below, however, the analysis and data cited in the *Recommended Decision* do not demonstrate that current rates are reasonably comparable within individual states; at best, they address only the general comparability of rates from a nationwide perspective. In any event, the Commission's task is not simply to satisfy itself that rates will be reasonably comparable today, which it cannot do on this record, but also to ensure that they are reasonably comparable in the years to come, as competition erodes the implicit subsidies underlying the current rate structure. The *Recommended Decision* makes no effort to meet that challenge. *Second*, the *Recommended Decision* asserts that its toothless "expanded certification process" would somehow meet the court's requirement to induce state action.[6] In fact, however, the certification process would provide the Commission no means of inducing most states to ensure comparability, because it would likely provide support to at most a few additional states, and it therefore does not begin to satisfy the Tenth Circuit's mandate.

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[4] *See In the Matter of Federal-State Joint Board on Universal Service*, CC Docket No. 96-45, *Ninth Report & Order and Eighteenth Order on Reconsideration*, 14 FCC Rcd. 20432 (1999).

[5] *See Qwest Corp. v. FCC*, 258 F.3d at 1204.

[6] *Recommended Decision* ¶ 51.

It is time for the Commission to adopt a federal universal service support mechanism that will withstand court scrutiny. The Commission must reject the Joint Board's recommendation and modify the federal support mechanism to induce states to ensure reasonable comparability within their borders. The most direct means of complying with the court's mandate is through wire center based support, such as that included in Qwest's proposal. Alternatively, if the Commission continues to base federal support on statewide average cost, it must make major changes to the computation of high cost support, in order to increase the number of states eligible for federal funding. As explained in the attached declaration of Dr. Banerjee, the *Recommended Decision* presents no reasonable justification for the current 135% benchmark. In fact, Dr. Banerjee's use of one of the statistical methods relied on in the *Recommended Decision* resulted in a much lower benchmark than 135%. In any case, what is clear is that the *Recommended Decision* does not provide the Commission with a vehicle to comply with the Tenth Circuit's mandate.

II. BACKGROUND

In *Qwest Corp. v. FCC*, the Tenth Circuit found that the Commission's "fundamental error" in the *Ninth Report and Order* was "in concerning itself only with 'enabling reasonable comparability *among states*,'" rather than *between rural and urban areas*.[7] While the Commission may rely on the states to ensure reasonable comparability within their borders, it must give the states an adequate incentive to do so -- such as "a 'carrot' or a 'stick,' [or] a binding cooperative agreement with the states[.]"[8] As Qwest explained in its earlier comments,

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[7] *Qwest Corp. v. FCC*, 258 F.3d at 1204 (citing *Ninth Report and Order* at ¶ 38) (emphasis supplied).

[8] *Id.*

this holding leaves the Commission with a circumscribed range of options on remand.[9] Because the states have severely conflicting interests in the allocation of federal universal service funds, and because they take vastly different views on the appropriate means of ensuring affordable rates within their borders, they are unlikely, at least in the foreseeable future, to enter into a binding "cooperative agreement" with the Commission on those very issues. Moreover, the Commission lacks clear authority simply to *compel* any given state to comply with the goals of this federal scheme.[10]

Thus, the Commission has only one feasible option: as the Tenth Circuit suggested, the Commission may "induce" the states to advance the goals of section 254 by imposing conditions on each state's receipt of federal universal service subsidies. Simply attaching conditions on current federal support would not satisfy the court's mandate, however, because most states receive no support under the current federal mechanism. Instead, Qwest proposed a revised federal mechanism that would meet the Commission's "responsibility to ensure that the states act" to promote reasonable comparability of rates within their borders, while preserving the Commission's long-standing emphasis on ensuring reasonable comparability *among* the states as well.[11] Qwest's proposal consists of three basic elements: two "tiers" of funding -- which would provide support to, respectively, high cost *wire centers* and high cost *states* -- plus a set of

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[9] Comments of Qwest Communications International Inc. in Response to the Tenth Circuit Remand at 10-12 (Apr. 10, 2002) ("Qwest Remand Comments").

[10] *See Printz v. United States*, 521 U.S. 898 (1997). Qwest assumes that the Commission is unlikely to assign to the federal fund the complete responsibility for allocating the roughly $4-6 billion necessary to ensure reasonable comparability on a nationwide basis. Qwest Remand Comments at 11.

[11] Qwest Remand Comments at 1. *See also* Reply Comments of Qwest Communications International Inc. in Response to the Tenth Circuit Remand (Apr. 25, 2002) ("Qwest Remand Reply").

conditions that states must meet before receiving any such funding.[12] This proposal would make between 47 and 49 states eligible for federal funding (depending on the variables selected) and thus would give each of them a concrete stake in helping realize section 254's objectives. At the same time, Qwest's proposal could cost one-half (or less) of the $2.1 billion price tag for more state-oriented alternatives, such as dramatically lowering the benchmark.[13]

III. THE COMMISSION MAY NOT HIDE BEHIND THE *RECOMMENDED DECISION'S* SUPERFICIAL ASSURANCES THAT RATES TODAY ARE REASONABLY COMPARABLE

In the *Recommended Decision*, the Joint Board wrongly suggests that additional federal funding is not needed, because rates are purportedly "reasonably comparable" today.[14] This finding also underlies the Joint Board's erroneous conclusion that additional federal support is not necessary "merely to induce states to ensure rate comparability[.]"[15] As discussed below, the data used to justify the status quo fail to show that rates are reasonably comparable today. Furthermore, this inquiry is too narrow, as it ignores the inevitable erosion of the implicit subsidies that generally allow rural rates to be priced significantly below cost.

A. The Commission Lacks a Sufficient Basis to Find that Current Rates Are Reasonably Comparable

Among other things, the Tenth Circuit directed the Commission to define the key statutory terms "reasonably comparable" and "sufficient" in a way "that can be reasonably related to the statutory principles, and then to assess whether its funding mechanism will be

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[12] Qwest Remand Reply at 1. In particular, Qwest's proposal would condition all federal funding on a state's certification that it has achieved reasonable comparability within its borders, and, over time, on its progress in producing such comparability through explicit, competitively neutral support mechanisms rather than through traditional implicit subsidies. Qwest Remand Comments at 1.

[13] Qwest Remand Reply at 7.

[14] *Recommended Decision* ¶¶ 34, 40-42.

sufficient for the principle of making rural and urban rates reasonably comparable."[16] Despite this directive, the *Recommended Decision* fails even to define "reasonably comparable."[17] That failure alone would violate the court's *Remand Order* and would make it impossible to determine whether the Commission's funding methodology complies with the statute.

Compounding this error, the *Recommended Decision* misinterprets the GAO Report. As pointed out by Commissioners Martin and Rowe, the GAO Report contains "serious deficiencies" that prevent it from being used to determine whether rates are reasonably comparable.[18] Most significantly, the Report overlooks state-to-state rate variations, because it simply compares national averages of rural, suburban, and urban areas. Thus, there is no basis for the Commission to conclude, based on the GAO Report, that rural rates *in <u>any</u> particular state* are reasonably comparable to urban rates. As Commissioner Rowe notes, "[i]t is easy to imagine a situation in which there is a section 254 problem but national averages [of urban and rural rates] are exactly equal."[19] Commissioner Rowe also notes other significant problems with the Joint Board's reliance on the GAO Report.[20] These are not just hypothetical problems. Even

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15 *Id.* ¶ 42.

16 *Qwest Corp. v. FCC*, 258 F.3d at 1202.

17 Rowe Statement at 2.

18 Martin Statement at 5-6; Rowe Statement at 2-4.

19 Rowe Statement at 3. *See also* Martin Statement at 6 ("<u>[N]ational</u> averages cited by GAO do not assist the Commission in addressing our core responsibility of whether rates in certain rural or high cost areas are comparable to rates in urban areas, or even whether rates vary significantly from state-to-state.").

20 Rowe Statement at 3-4 (noting inclusion of areas served by rural carriers, use of too small a sample size, and other methodological problems).

the GAO Report itself shows that there are widely divergent rates among different geographic areas.[21]

In Qwest's region, there is a wide variance in its retail rates. For example, in rural areas in Wyoming, residential customers pay approximately $32.00 per month for basic phone service, after state and federal universal service credits. In contrast, the statewide rate for residential service in New Mexico is less than $13.00, despite a recent rate increase. Such disparities far exceed the 70-80% discrepancy that the Tenth Circuit suggested was inconsistent with the statutory principle of "reasonable comparability."[22]

B. A Finding of Reasonable Comparability Cannot Properly Rely on the Continuing Existence of Implicit Subsidies

Even if the funding mechanism were sufficient to produce reasonably comparable rates *now*, which it is not, it must also preserve reasonable comparability over the long term, as competition erodes the sources of existing cross-subsidies. As such, the funding mechanism must encourage states to rebalance rates and move to explicit subsidies. Nevertheless, the Joint Board's own reasoning presupposes that at least some states will continue using "implicit . . . mechanisms" to transfer support from low-cost lines to high-cost lines within a state.[23] That reasoning betrays a failure to face up to the reality that, as competition develops, those traditional mechanisms will become unsustainable. In short, there can be no "reasonably comparable" rates over the long term without rate rebalancing.

As the Commission is well aware, many states have demonstrated an intractable reluctance to make the transition from unsustainable implicit cross-subsidies to explicit,

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[21] *Id.* at 3. *See also id.* at 11 (discussing data compiled by the Rural Utility Service showing a substantial difference between national average and average urban cost).

[22] *Qwest Corp. v. FCC*, 258 F.3d at 1201.

[23] *Recommended Decision* ¶ 24.

competitively neutral funding mechanisms. Absent strong encouragement from the Commission, such states are unlikely to act to replace implicit subsidies until they have reached a crisis point where these subsidies have been virtually eliminated. Given the complexity of these issues, it could easily take a year or longer for a state to rebalance its rates and establish an explicit subsidy system, by which time the incumbent could be facing serious financial harm. It would be both unfair and irresponsible to allow this to happen.[24] Just as important, it would be inconsistent with the Commission's long-term obligations under section 254, as interpreted by the Tenth Circuit.

IV. THE *RECOMMENDED DECISION* IGNORES THE TENTH CIRCUIT'S CENTRAL MANDATE TO CREATE SUFFICIENT INDUCEMENTS TO ENSURE REASONABLY COMPARABLE RATES WITHIN STATE BOUNDARIES

Stripped to its essentials, the *Recommended Decision* embraces the very status quo that the Tenth Circuit found unlawful. As before, only a small minority of states would receive federal subsidies, because federal support would be based solely on statewide average costs. Consequently, there would be no "inducement" for most states to ensure reasonable comparability of rates within their boundaries. In this regard, the Joint Board's proposal would not provide federal support that is "sufficient" to ensure reasonable comparability, as required by the Tenth Circuit.

The Joint Board wrongly asserts that an expanded certification process would "meet[] the court requirement to induce state action to achieve rate comparability."[25] It is not clear why the Joint Board believes that this process would "encourage[] states to scrutinize their rates using the

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[24] The Tenth Circuit seems to have anticipated that it would be necessary for states to establish mechanisms to ensure comparability. *See Qwest Corp. v. FCC*, 258 F.3d at 1203 ("[T]he FCC must ensure that these [state] mechanisms exist."), 1204 (The Commission "must . . . undertake the responsibility to ensure that the states act.").

[25] *Recommended Decision* ¶ 51.

basic service rate template, to determine whether they are reasonably comparable, and if not, to take actions to make them reasonably comparable."[26] Because the Joint Board's proposal is so imprecise, it is difficult to determine how many states would qualify for the additional funding, but it appears to be a stop-gap measure that may bring in, at most, a small handful of states.

Rather than inducing states to act, the certification procedure would simply require states to tell the Commission what their rates are in various areas. For the states that would not qualify for federal funding -- a large majority -- there would be no incentive to demonstrate comparable rates, or to take actions to make their rates reasonably comparable. In such states, ratepayers could be stuck with high rates based on their state commission's failure to act.

As Qwest discussed in its earlier filings, the only workable method of "inducing" states to take the necessary steps to ensure reasonably comparable rates is to provide federal high cost funding to states that take such steps, and withhold it from those that do not. For a conditional funding system to be successful, however, a majority of states must actually qualify for funding and thus have an incentive to meet federal policy objectives. Any mechanism that brings in only a minority of states, such as the Joint Board's "expanded certification process," cannot "induce *adequate* state action" to ensure reasonable rate comparability. As the Tenth Circuit made clear, the Commission may not simply assume that a majority of states will "act on their own to preserve and advance universal service."[27] However, that is exactly what the Joint Board proposes for the Commission to do.

The proposed certification process suffers from at least two other significant problems. First, the certification requirement is too narrow. It appears that a state could certify that rates within its borders are reasonably comparable, even if such comparability depends on continued

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[26] *Id*.

existence of implicit subsidies. As previously discussed, it is imperative that the Commission induce states to establish *sustainable* mechanisms to ensure reasonable comparability. Second, the certification process is poorly defined both in terms of what it takes to qualify for additional support and how the level of such additional support will be determined. Commissioner Rowe details the difficulty of making meaningful rate comparisons, as well as the risks of discriminatory treatment and inefficient incentives for states to maximize their support.[28]

In short, the expanded certification process outlined in the *Recommended Decision* fails to comply with the requirement that the Commission "develop mechanisms to induce adequate state action." As discussed above, current experience indicates that, without an incentive to do otherwise, some states may simply ignore substantial rate discrepancies within their borders.[29] Accordingly, in order to comply with the Tenth Circuit's mandate, the Commission must adopt a support mechanism that would provide support to the vast majority of states, on the condition that they take the steps necessary to ensure sustainable and reasonable comparability of rates within their borders. A more granular approach, such as Qwest's "Tier 1" proposal to fund high-cost wire centers, would best serve these purposes.[30]

V. IF THE COMMISSION DECIDES TO MAINTAIN A FUNDING SYSTEM BASED SOLELY ON STATEWIDE AVERAGES, IT MUST ADJUST THE BENCHMARK TO BRING IN MORE STATES

The most direct way to comply with the court's mandate is to adopt a wire center approach, such as that proposed by Qwest. As noted Qwest's approach would distribute federal

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27 *Qwest Corp. v. FCC*, 258 F.3d at 1204.

28 Rowe Statement at 17-21.

29 The Joint Board also appears to envision only mild oversight by the Commission over the certification process. Indeed, the Joint Board recommends that the Commission "accord substantial deference to these state certifications." *Recommended Decision* ¶ 51.

30 *See* Qwest Remand Comments at 12-20.

support to between 47 and 49 states, depending on the variables that are chosen, while keeping the federal price tag reasonable. If the Commission is intent on maintaining a funding system based *solely* on statewide averages, however, it must, at a minimum, adjust the benchmark to distribute support to more states. As discussed below, there are at least three types of changes to the benchmark that could accomplish this objective. Most effective would be the employment of a step function that would provide gradually more support for costs that exceed certain threshold or "steps" above the national average.[31] In the alternative, the Commission could employ an "urban" benchmark or lower the current 135% trigger for federal support. Given the Commission's obligation to devise suitable inducements for the states as a whole (and not just a few of them), if the Commission continues to base support solely on statewide averages, it has no choice but to adopt one or more of these changes to the current system.

A. A Properly-Calibrated Step Function Would Make More States Eligible for Federal Funding, and Thus Subject to Lawful Federal Inducements to Achieve Reasonable Comparability

The most effective method of making states eligible for federal funding, and thus subject to lawful federal inducements to achieve "reasonable comparability," is to employ a step function that would fund the highest costs in each state. For instance, BellSouth proposes some "supplemental support" for states with average costs above 100% of the national average, and then additional support for costs above 115% of the national average. Like Qwest's proposal, BellSouth's proposal aims to provide a "carrot" to more states. However, because it focuses on statewide averages, it does not respond to the Tenth Circuit's remand as directly as Qwest's wire center approach. Nevertheless, it would move in the direction required by the court by providing

[31] *See Recommended Decision* ¶ 42.

federal support, and potentially the required inducement, to more than the current handful of states that receive federal support.

The Joint Board did not foreclose this option, but put off a decision on its merits, in light of the need to respond "expeditiously" to the court's remand.[32] There is no reason not to implement a step function at this time; it would not slow down the Commission's resolution of these issues and, as discussed, is a necessary element of any lawful funding scheme otherwise based on statewide average costs.

B. At a Bare Minimum, the Commission Should Increase the Number of States Eligible for Federal Funding, Either by Employing an "Urban" Benchmark or by Lowering the 135% Trigger for Federal Support

If the Commission does not undertake any of the necessary steps outlined above, it should, at a bare minimum, increase the number of states eligible for federal funding, either by employing an "urban" benchmark or by lowering the current 135% trigger. Only by doing so can the Commission begin to address the Tenth Circuit's requirement that the Commission create an inducement for states to ensure reasonable comparability. Moreover, the use of a national average benchmark with a 135% trigger fails even to *allow*, much less induce, states to ensure reasonable comparability.

1. The National Average Benchmark does not Allow the Statutorily-Required Comparison of Rural and Urban Rates

In the *Ninth Report and Order*, the Commission defined "reasonably comparable" as "some reasonable level above the national average forward-looking cost per line."[33] In reviewing this and other definitions of that term provided by the Commission, the Tenth Circuit noted that "[t]he Act calls for reasonable comparability between rural and urban rates; these definitions

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[32] *Id.*

[33] *Ninth Report and Order*, 14 FCC Rcd. at 20463 ¶ 54.

simply substitute different standards."[34] Despite this rebuke, the Joint Board continues to recommend use of a benchmark based on national *average* cost, rather than urban cost.

The Joint Board acknowledges that the current 135% national *average* benchmark is equivalent to a 165% *urban* benchmark, which is "near the 70-80% range of variability that the court doubted was reasonably comparable."[35] Nevertheless, the Joint Board erroneously rejects the use of an urban benchmark, principally because it might require more federal support. In this regard, the Joint Board is off base. Federal high cost support *should* be increased. As discussed above, the record does not demonstrate that rates are reasonably comparable today. Increased federal support is also necessary to make more states eligible for federal support, in order to induce them to ensure reasonable rate comparability, as required by the Tenth Circuit. Finally, the Joint Board ignores the court's direction that the attainment of the goals identified in section 254(b), including "sufficient" federal support and "reasonable comparability" of rural and urban rates, cannot be sacrificed in order to maintain a smaller federal fund.[36]

Even more perplexing is the Joint Board's opposition to the urban benchmark on grounds that it "will not ensure that urban and rural rates will be reasonably comparable."[37] It is not clear how the Joint Board can simultaneously contend that current federal support ensures reasonable comparability, but that more support will not.

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[34] *Qwest Corp. v. FCC*, 258 F.3d at 1201.

[35] *Recommended Decision* ¶ 41.

[36] Any suggestion that providing additional federal support would give incumbents a windfall is misplaced. Under section 254(e), and the Commission's rules, federal universal service support must be used "only for the provision, maintenance, and upgrading of facilities and services for which the support is intended." 47 U.S.C. § 254(e). In practice, each dollar of federal support is offset by a reduction in intrastate rates.

[37] *Recommended Decision* ¶ 41.

2. If the Commission Continues to Base Federal Support on a Single Benchmark, it Should Lower the Funding Threshold Substantially from 135%

If the Commission continues to base federal support solely on statewide average costs, with a single benchmark, it should lower the funding threshold substantially below 135% to ensure a sufficient number of state recipients. The Commission has identified no legitimate basis for maintaining the current 135% benchmark.

Standard Deviation Analysis. As explained by Dr. Banerjee, the standard deviation analysis relied on in the *Recommended Decision* does not provide a valid justification for the current benchmark.[38] As an initial matter, this analysis focuses on the wrong question, by comparing outlier costs to median costs, rather than rural-to-urban costs. Thus, even if the Commission could show that the 135% figure represents a statistically "natural" means of identifying outlier states, that showing would not begin to meet the Commission's separate obligation on remand to create effective inducements for *all* states to ensure reasonable comparability of rates within their borders. As discussed, the only feasible way the Commission can provide such inducements is to ensure some level of federal funding for the vast majority of states, not just the outliers.

In any event, the Recommended Decision provides no meaningful justification for the 135% figure *even as a means of identifying outlier states*. As Commissioner Rowe explains, standard deviation analysis assumes that "outlying" data points are the product of a measurement error, and there is no basis to equate such data with "outlying" high cost states.[39] Furthermore, the Joint Board fails to explain why only the top 2.5% or 5% of statewide average costs should be deemed "high enough" to merit federal universal service support.

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[38] Banerji Declaration at 6-9.

In terms of statistical principles, the Joint Board fails to follow common conventions by applying an analysis (*i.e.*, the two-standard-deviation analysis) that is intended only for data with normal distribution to a data set that clearly does not have normal distribution.[40] As noted by Dr. Banerjee, the Joint Board could have applied other widely-accepted statistical practices that would be more appropriate for such a distribution of data, and that likely would have led to different answers.[41] Notably, the Joint Board's theoretical analysis suggests that one or two states (2.5% of 50 states) should receive support, rather than the eight that currently receive support. In summary, the Joint Board's standard deviation analysis appears to be little more than an *ex post facto* justification, and a wholly flawed one at that, for the current 135% benchmark.

Cluster Analysis. The cluster analysis cited in the *Recommended Decision* is similarly unimpressive. As Dr. Banerjee discusses, the formation of clusters is, at least in some key respects, arbitrary.[42] Indeed, "[t]here is nothing particularly definitive or dispositive about cluster analysis as a means of finding groups within data, certainly not for proving or disproving a preconceived hypothesis."[43] This is exactly how the Joint Board uses that analysis. The Joint Board's cluster analysis is also dependent on this year's data, even though the 135% benchmark was adopted in 1999. As noted by Commissioner Rowe, "[i]f cluster analysis had been applied a year ago, then, it would have supported *reducing* the 135 percent benchmark[,]" which would

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39 Rowe Statement at 6.

40 Banerjee Declaration at 8, n.7.

41 *Id.* at 9.

42 *Id.* at 10-26.

43 *Id.* at 14-15 (relying on a highly respected text on cluster analysis).

have increased the amount of federal support.[44] Once again, the statistical analysis in the *Recommended Decision* appears to be intended simply to confirm the existing methodology.

In evaluating the cluster analysis cited in the *Recommended Decision*, Dr. Banerjee conducted several of his own cluster analyses. Tellingly, he received very different results. When he used a two-cluster solution, like that relied on in the *Recommended Decision*, his results suggested that the benchmark should be set between 107 and 117%. A benchmark in that range would do more than the *Recommended Decision* to satisfy the Commission's obligations on remand to ensure reasonable rate comparability within state boundaries, because it would give the Commission an effective "carrot" with respect to a greater number of states. For example, reducing the benchmark to 108% would distribute federal support to about half the states. At the same time, this approach would accomplish that objective less effectively -- and would present a significantly higher federal price tag -- than Qwest's wire-center-based approach.[45]

VI. CONCLUSION

For the reasons discussed above and in Qwest's earlier filings, the Commission should reject the *Recommended Decision*, which fails to comply with the Tenth Circuit's mandate. Instead, the Commission should (1) provide federal funding for all *wire centers*, regardless of state boundaries, whose average per-line costs exceed a given dollar benchmark, (2) provide supplemental funding for *states* that have such high statewide average costs that, even taking into account the wire center funding just mentioned, would lack the internal resources to keep their rates reasonably comparable to those in other states, and (3) condition all federal funding on a state's certification that it has achieved reasonable comparability within its borders and, over

[44] Rowe Statement at 5 (emphasis in original).

time, on the state's progress in producing such comparability through explicit, competitively neutral support mechanisms rather than traditional implicit cross-subsidies.

Respectfully submitted,

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[45] *See* Qwest Remand Reply at 7. For example, Qwest's proposal would distribute federal support to 46 states at a smaller cost ($1.1 billion) than reducing the benchmark to 108%, even though the latter would make only 25 states eligible for federal funding.

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Declaration of Aniruddha Banerjee, Ph.D.

1. My name is Aniruddha Banerjee. I am a Vice President at National Economic Research Associates, Inc. ("NERA"), and my business address is One Main Street, 5th Floor, Cambridge, Massachusetts 02142. The purpose of my declaration is to critically appraise, on behalf of Qwest Communications International, Inc. ("Qwest"), the two statistical methods employed by the Federal-State Joint Board ("Joint Board") to recommend that the appropriate benchmark for determining a state's eligibility for federal universal service support be that the state's average statewide cost to provide local exchange service must exceed 135 percent of the nationwide average such cost. In this regard, I conclude that neither of the two statistical methods appear to have been applied correctly to provide a basis for the Joint Board's choice of its 135 percent benchmark. In fact, my own use of cluster analysis (one of the methods employed by Joint Board) reveals that the appropriate benchmark should be considerably lower, and that many more states should be eligible for federal universal service support than the number implied by the Joint Board's benchmark.

2. Qualifications. I have been an economic consultant with the Communications Practice at NERA for nearly eight years, prior to which I was employed by various telecommunications-related entities, such as BellSouth Telecommunications (1993-1995), Bell Communications Research (1989-1993), and AT&T Communications (1988-1989). Prior to joining the telecommunications industry, I was first an Instructor, then an Assistant Professor, of Economics at the Pennsylvania State University where I taught and conducted research in economics from 1982-1988. I graduated from the University of Delhi, India, with a B.A. (with Honors) in Economics in 1975, and an M.A. in Economics in 1977. I received a Ph.D. in Agricultural Economics from the Pennsylvania State University in 1985. While serving as a member of the faculty in the Economics Department at Penn State, I taught several graduate and undergraduate courses, including microeconomic and macroeconomic theory, industrial organization, public finance, statistical foundations for economics, and econometrics. I conducted research in several areas of econometrics (particularly, time series analysis), developed and taught a new course in econometrics for advanced Ph.D. students, and helped to develop an econometrics curriculum for Penn State's Master of Policy Analysis program. I have over 25 years of experience with statistical and econometric methods, and have published papers applying those methods of analysis to futures markets and telecommunications issues.

3. At NERA, I serve as an expert witness before the Federal Communications Commission ("FCC") and state regulatory agencies on behalf of several

telecommunications companies on matters of regulatory economics. These include, among others, local and long distance competition policy, universal service, interconnection, unbundling and resale, mergers and anti-trust violations, traditional and incentive regulation, retail and wholesale service quality, Internet economics and inter-carrier compensation, and proxy cost models. I also advise telecommunications clients and other entities on matters of strategic and policy interest that require sophisticated statistical and econometric analysis, such as in the areas of pricing, cost, demand forecasting, market share analysis, price index development, etc.

4. In particular, I am familiar with the history of universal service support in the telecommunications industry in the United States, the relationship among universal funding support, reform of access charges, and rate rebalancing and rationalization for local exchange carriers ("LECs"). Since the passage of the Telecommunications Act of 1996 ("1996 Act"), I have followed developments, at both state and federal levels, regarding the removal of implicit subsidies from the rates for supporting services, the use of proxy cost models to determine loop costs, the parallel (and sometimes disjoint) structure of inter- and intrastate access charges, and the proposed use of benchmarks for determining state-level eligibility for federal universal service support. I have first-hand experience with developing elaborate spreadsheet models to determine transfers among states and telecommunications companies of such support, under various assumptions about corresponding acts by states to reform the local exchange rates and universal service support funding

within their respective jurisdictions. I have also testified before various state regulatory agencies regarding alternative proxy cost models submitted by various interested parties in the years leading up to the development of the FCC's own hybrid proxy cost model.

5. The Joint Board's Recommended Benchmarking Rule for Federal Universal Service Support. The Joint Board's recent release of its Recommended Decision marked an important step in a long rulemaking process for determining eligibility for federal universal service support.[1] This process included a remand by the 10th Circuit Court of Appeals of a prior Joint Board order on the determination of that eligibility, in which the court sought, among other things, a more adequate explanation from the Joint Board for its funding benchmark set at 135 percent of the nationwide average cost.[2] In addressing this requirement, the Recommended Decision reaffirmed, using two forms of statistical analysis, the Joint Board's earlier recommendation to use the 135 percent benchmark.

6. The Joint Board's first justification was based on a "standard deviation analysis." In this respect, the Joint Board reasoned as follows:

> In a normal distribution, data points within two standard deviations of the mean will comprise approximately 95% of all data points. In other words, use of two standard deviations will identify data points that are truly outliers within the sample studied. … As applied to the cost of non-rural lines, the measurement of two standard deviations

[1] Federal-State Joint Board on Universal Service, CC Docket No. 96-45, Recommended Decision (Recommended Decision), October 16, 2002.

[2] Federal-State Joint Board on Universal Service, CC Docket No. 96-45, Ninth Report and Order and Eighteenth Order on Reconsideration (Ninth Report and Order), November 2, 1999, remanded, Qwest Corp. v. FCC 258 F.3d 1191 (10th Cir. 2001).

> from the national average cost results in approximately 132% of the national average cost. Based on this information, the Joint Board concludes that the 135% benchmark is a reasonable dividing line separating high-cost states from the remainder of average and low-cost states.[3]

7. The Joint Board's second justification was based on a "cluster analysis." In this respect, the Joint Board reasoned as follows:

> Cluster analysis is an analytical technique that organizes information around variables so that relatively homogeneous groups, or clusters, can be identified. The Joint Board used cluster analysis to identify groups of states that had similar cost characteristics, thereby warranting different treatment regarding universal service support. Specifically, states were sorted from lowest- to highest-cost based on statewide average cost per loop. Clusters were identified in this ranking if the average costs between states were greater than "cluster split differences" ranging from 2.5 to 0.5. Under this analysis, Mississippi was the first to break out into a separate cluster, and the second was the District of Columbia. The first group of states to break out into a separate rural, high-cost cluster included Kentucky, Maine, Alabama, Vermont, Montana, West Virginia and Wyoming. The remaining states, ranging from New Jersey to Nebraska, formed a separate urban, low-cost cluster. When Mississippi and the District of Columbia, the respective high- and low-cost "outliers," were combined into the two larger clusters, "cluster stability" was achieved for a wide range of numerical values from 2.5 to 0.85. "Cluster analysis" means that the same clusters are maintained even as the numerical values are varied, indicating a strong similarity among members of the cluster groups. Because cluster analysis identifies a high-cost, rural cluster of states that matches the group of states currently receiving support under the non-rural high-cost support mechanism, the Joint Board finds that the cluster analysis empirically supports the current 135% benchmark.[4]

8. In this declaration, I take no position on whether the statewide average cost is the proper metric to base all considerations of federal universal service support. I

[3] Recommended Decision, ¶36. Footnotes omitted.

[4] Recommended Decision, ¶37. Footnotes omitted.

understand that an alternative view holds that local exchange service costs vary even across rural and urban areas within states—regardless of whether those states are predominantly rural or predominantly urban—making the statewide average cost an inherently misleading statistic. However, even if it were proper to use that measure of cost, there would remain serious deficiencies in the statistical justifications advanced by the Joint Board for its choice of the 135 percent benchmark. My declaration addresses these deficiencies in detail.

9. Critical Appraisal of the Joint Board's Use of Standard Deviation Analysis (First Justification). In relying on the normal distribution to identify the 5 percent of values in a sample that lie typically at a distance of more than two standard deviations above and below the mean, the Joint Board espoused a statistical principle that is well-established and frequently employed to identify outliers. However, the Joint Board also noted the following about statewide average costs:

> The cost data are not normally distributed, because there are more low-cost, urban lines than high-cost, rural lines. We are interested in providing support to states with more high-cost lines, so it is appropriate to use the two standard deviation measurement to identify outliers even though this measurement may identify more than expected in a normal distribution.[5]

10. The Joint Board's pursuit of a justification for its proposed 135 percent benchmark is extraordinary and unwarranted in view of its own admission that statewide average costs are not normally distributed, to which the "two standard deviations

[5] Recommended Decision, fn. 91 (attached to ¶36). Emphasis added.

from the mean" rule to identify outliers clearly does not apply.[6] The acknowledgement that average cost per loop data are non-normally distributed is inconsistent with its use of the two standard deviations rule.

11. Moreover, in its unwarranted application of this rule, the Joint Board made no adjustment for the fact that only certain outliers, namely, "very high" average costs, are of concern, whereas others, namely, "very low" average costs, are not. Under the normal distribution, at distances of 1.96 (or, in round numbers, 2) times the standard deviation from the mean, the two tails collectively encompass 5 percent of values, i.e., each tail only contains 2.5 percent of values. Therefore, if, after sorting the states by their average costs, only the highest 5 percent were of concern, then the Joint Board should have adopted a different standard deviations-based rule that would have allowed it to identify 5 percent of values in each tail, i.e., 10 percent in all. This rule would have been to cut off 1.645 times the standard deviation, rather

[6] As an aside, I note that the Joint Board found correctly that the average cost data are not normally distributed, although its reason for that finding was, at best, ambiguously worded. The fact that "there are more low-cost, urban lines than high-cost, rural lines" does not per se suggest a non-normal distribution. The normal distribution has three important properties: it is (1) symmetric, i.e., the arithmetic mean is the same as the median, which implies that half of the values in the sample lie above the mean and the other half below it; (2) bell-shaped with both tails disappearing asymptotically, i.e., it encloses the vast majority of sample values in the area closer to the center, rather than to the tails, of the distribution, and (3) mesokurtic, i.e., has a shape that encloses 95 percent of the sample values within the two standard deviations limit above and below the mean. The reason provided by the Joint Board is insufficient to construe a non-normal distribution because the Joint Board does not identify the range of costs that it defines as "low" relative to the range that it defines as "high." Any use of its 135 percent benchmark to separate "low" from "high" cost lines would amount to circular reasoning. The distribution of average costs would be non-normal if any one of the three conditions given above was violated. First, that distribution could conceivably be non-symmetric. This could happen, e.g., if most such costs fell into a relatively dense part of the distribution, but a few states' average costs were "high" enough to create a long and stretched right tail of the distribution. Presumably, this is what the Joint Board had in mind. Equally, non-normality could arise from a non-bell shaped distribution of average costs or a different shape despite symmetry (such as a "fat-tailed" distribution where the regions beyond the two standard deviations limit enclose more than 5 percent of the values). Neither of these forms of non-normality requires that the distribution be skewed in one direction or another, i.e., be non-symmetric.

than 1.96 (or, in round numbers, 2) times the standard deviation, which would have been appropriate only to identify a total of 5 percent under both tails. The Joint Board never explained why the 5 percent cut-off point was germane to its analysis. Nor did it explain why "outliers" should only be defined with respect to this arbitrary 5 percent cut-off point. The Joint Board failed to explain why only the top 2.5 percent of statewide average costs should be deemed "high enough" to merit federal universal service funding support.[7] Finally, given the typical spread between local exchange service costs in urban and rural areas even within states, the Joint Board never explained why its standard deviations analysis was either relevant or useful for revealing cost disparities that could be closed with the help of federal universal service support.

12. Taken together, these failures hardly suffice to address the 10th Circuit Court's remand of the Ninth Report and Order on the grounds that it failed to explain adequately the Joint Board's initial choice of the 135 percent benchmark. If the distribution is truly normal, and only the 2.5 percent of states with the highest average costs should qualify for federal support under the Joint Board's reasoning, then the number of states receiving such support would be between one and two. Yet, the Joint Board's 135 percent benchmark, supposedly justified by such

[7] The Joint Board's dilemma is readily evident from the fact that it mechanically applied the "two standard deviations rule" to identify the values that should theoretically correspond to 2.5 percent of states (only those in the right tail of the distribution), yet found that the application of that rule resulted in 8 states being deemed eligible for support, i.e., 15 percent of the states. The Joint Board even acknowledged this fact ("this measurement may identify more than expected in a normal distribution"). Recommended Decision, fn. 91. This is clear evidence of a misapplication of the "two standard deviations" rule intended for normally distributed data to an actual distribution that is not even remotely normal (as the Joint Board itself acknowledged).

analysis, selects eight states as being eligible for support. Clearly, the recommended benchmark is incorrect. The presentation of what is, in essence, ex post facto justification for the 135 percent benchmark—on the strength of the Joint Board's standard deviations analysis—makes the entire exercise resemble more an answer in search of a question, rather than the other way around.

13. The biggest drawback in the Joint Board's mechanical application of the "two standard deviations" rule is its failure to explore the actual (or "empirical") distribution of average cost by state.[8] In view of its explicit acknowledgement of the non-normality of the cost data, the Joint Board's failure to account for the empirical distribution of those data is simply inexplicable. Had the Joint Board examined the empirical distribution of average cost, it could have applied outlier identification rules (even if only to identify an arbitrary percentage of the data as outliers) that were properly dependent on the actual shape of that distribution. For example, bootstrapping or other resampling techniques (for which software is now readily available) are now widely accepted for constructing empirical distributions from given data and for computing their most important descriptive statistics, namely, mean, standard deviation or variance, and higher moments, if necessary. Once these statistics are known, it is possible to exclude the area under the empirical distribution that truly corresponds to a given percentage (however justified) of the data, whether under the left tail, the right tail, or both.

[8] In all, the Joint Board examined cost data for 51 jurisdictions (49 states plus the District of Columbia and Puerto Rico). Delaware was not included in the analysis.

14. Critical Appraisal of the Joint Board's Use of Cluster Analysis (Second Justification). The Joint Board correctly stated the purpose of any cluster analysis as being the finding of homogeneous groups in data, such that members of any given cluster are as similar as possible to each other, while they are dissimilar from members of other clusters. Conceptually, this seems like a simple task, particularly when there is only one characteristic or trait, e.g., average cost, with which to form clusters. However, as I discuss below, the formation of clusters is, at least in some key respects, arbitrary and depends crucially on (1) how similarity (or dissimilarity) is measured and (2) whether hierarchical or non-hierarchical methods of clustering are used.

15. Without turning this into a full-blown primer on cluster analysis, it is important first to review the principal methodological issues involved in order to critically appraise the Joint Board's application of such analysis to statewide average cost data.[9] As noted above, cluster analysis assigns observations in a sample or data set to various clusters or groups. The principle of cluster analysis itself places no constraint on the analyst regarding the number or type of clusters that can be formed, although the methodology followed for forming clusters could do so. That is, in principle, the analyst may be free to choose the appropriate stopping point, namely, the actual number of clusters (whether two, three, or more) he or she ends up with after having

[9] There are several excellent texts and other expositions of cluster analysis which the interested reader may consult. See, e.g., L. Kaufman and P.J. Rousseeuw, Finding Groups in Data: An Introduction to Data Analysis, New York: John Wiley & Sons, 1990, B.S. Everitt, Cluster Analysis, 3rd ed., London: Edward Arnold, 1993, or S. Sharma, Applied Multivariate Techniques, New York: John Wiley & Sons, 1996.

started with each individual observation by itself.[10] This seeming lack of constraint may be reinforced by the method itself that is used to form clusters.

16. If the analyst uses "hierarchical" clustering algorithms, then it is possible for different numbers of clusters to be formed, depending on (1) how much "similarity" is sought for observations to be assigned to the same cluster and (2) how similarity is measured or determined in the first place.[11] Typically, similarity (or dissimilarity) is determined in this context by a statistical measure of "distance," of which there are several available to analysts, although association or correlation coefficients may be used as well.[12] Intuitively, distance measures (whichever is chosen) work as follows. As clusters are formed from individual observations, distance measures are applied repeatedly to determine the "closeness" between observations (to determine whether or not they belong in the same cluster) and the closeness between clusters

[10] Implicit in this is the idea that the number of clusters should be no fewer than two if the clustering exercise is not to become trivial.

[11] There are two classes of hierarchical clustering algorithms that work essentially in opposite directions. The more popular of the two, the class of "agglomerative" methods, starts with each observation as a separate entity and assigns each to a cluster, continuing the process of forming larger clusters from smaller ones until only one is left. The analyst may stop short of reaching the final single cluster, but exactly where he or she stops the agglomeration process will determine the number of clusters formed. The other class of hierarchical clustering algorithms, the class of "divisive" methods, proceeds in exactly the opposite direction. It starts with all observations assigned to a single cluster and, in successive steps, forms smaller (and more) clusters from larger (and fewer) clusters. Again, the analyst may use judgment in choosing where to stop, e.g., by relying on some measure of similarity or distance between clusters. For the benefits and drawbacks of the hierarchical approach, in general, see Kaufman and Rousseeuw, op cit., Sec. 3.2, or Sharma, op cit., Sec. 7.9.

[12] The most general measure of distance is the Minkowski distance, of which the Manhattan (or "city-block") distance and the squared Euclidean distance are special cases that are commonly used. Other measures of distance, like the Mahalonobis distance, may be used as well, or the analyst may rely on various association coefficients or correlation coefficients, depending on whether the data are binary or continuous. See, e.g., Sharma, op cit., Sec. 7.10. Besides distance measures, the analyst may rely on other statistics to determine cluster number, size, and stability, e.g., root-mean-square standard deviation of the new cluster, semi-partial R-squared, and R-squared. See, Sharma, op cit., Sec. 7.6.

(to determine whether or not the clusters formed are stable or could metamorphose into other clusters of different shapes and sizes).

17. Compounding this process is the fact that the analyst has the freedom to choose even how the distance measure (whichever is chosen) may be applied. For example, the distance could be that between an individual observation and the "centroid," i.e., the "average" observation, of an existing cluster (or between the centroids of two different clusters). This is known, appropriately enough, as the "centroid method." Alternatively, the distance could be the minimum between all possible pairs of observations in two separate clusters (the "nearest neighbor" or "single-linkage" method), or the maximum between all possible pairs of observations in the two clusters (the "farthest neighbor" or "complete-linkage" method), or the average between all possible pairs of observations in the two clusters (the "average-linkage" method). A fifth way to form clusters in a hierarchical method—known as "Ward's method"—does not use distance measures per se, but rather relies on maximizing within-cluster homogeneity by minimizing the total within-cluster error sum of squares.[13]

18. Cluster formation may alternatively be pursued by using the class of algorithms frequently called "non-hierarchical" or "partitioning" cluster analysis. Unlike the hierarchical approach, the partitioning approach starts with a pre-determined number of clusters and then resorts to various algorithms to assign individual observations to the different clusters. Here, the analyst has fewer degrees of

freedom or subjectivity because the number of clusters is pre-determined, although what that number is, or should be, is itself potentially a matter of subjective choice. Once that choice has been made (say, *k* clusters), however, all partitioning algorithms proceed by (1) selecting *k* cluster centroids or "seeds," (2) assigning each observation to the closest cluster, based on some measure of distance, (3) reassigning each observation among the *k* clusters according to a pre-determined stopping rule, and (4) stopping the cluster assignment process once the stopping rule indicates no further need for reassigning observations among different clusters.

19. Once again, even with a pre-determined number of clusters, the analyst has a fair bit of freedom to determine (1) how the initial seeds for the clusters should be chosen and (2) what the reassignment rule should be. Unfortunately, several options are available under each, resulting in a large number of possible combinations of seeds and reassignment rules.[14] This means that, even with a pre-determined number of clusters, the precise size and shape of a cluster may depend largely on which combination of seeds and reassignment rules is chosen by the analyst.

20. At this point, it is important to take stock of the two cardinal lessons about cluster analysis. First, whether a hierarchical or a partitioning method of clustering is used can make a big difference to the number, size, and shape of clusters formed from

[13] For a thorough discussion of all of these issues, see Sharma, op cit., Sec. 7.5.

[14] Sharma, op cit., Sec 7.7 lists six ways to choose the seed and three different reassignment rules. This gives 18 possible combinations. Whenever cluster means or medians are chosen as the centroids or seeds, the algorithms that result are known familiarly as *k*-means and *k*-medians algorithms, respectively. The use of means accounts for all observations but remains sensitive to outliers. In contrast, the use of medians alleviates the sensitivity to outliers, but disregards the actual the complete distribution of the observations in the process.

given data. The hierarchical method does not pre-determine the number of clusters, but leaves the analyst with a complicated set of decisions (compounded by the variety of decision rules available) for arriving at the final array of clusters. In contrast, the partitioning method starts with a pre-determined number of clusters (which, in itself, may be an arbitrary choice) but, in the end, leaves the analyst with an exercise in mere classification of objects, rather then the true formation of homogeneous clusters. For these reasons, some experts suggest combining the two approaches when performing cluster analysis: (1) use hierarchical clustering at the first step to arrive at a tentative choice of the number of clusters and (2) with that number of clusters so set, use the partitioning method to refine the formation of those clusters. For example, Sharma states:

> Hierarchical clustering methods do not require a priori knowledge of the number of clusters or the starting partition. This is a definite advantage over nonhierarchical methods. However, hierarchical methods have the disadvantage that once an observation is assigned to a cluster it cannot be reassigned to another cluster. Therefore, hierarchical methods are sometimes used in an exploratory sense and the resulting solution is submitted to a nonhierarchical method to further refine the cluster solution. That is, hierarchical and nonhierarchical methods could be viewed as complementary clustering methods rather than as competing methods.[15]

21. The second, and larger, lesson is that unless great care is taken in conducting cluster analysis and making inferences from the results, the analyst may reach a conclusion that is more artifactual (i.e., a creation of the analyst's own choices and predilections) than real. There is nothing particularly definitive or dispositive about

[15] Sharma, op cit., at 211. Emphasis added.

cluster analysis as a means of finding groups within data, certainly not for proving or disproving a preconceived hypothesis. In that respect, cluster analysis does not amount to formal or rigorous statistical testing, and, no matter how assiduously clusters are formed, the room is always left open for alternative inferences. Kaufman and Rousseeuw state this succinctly:

> The choice of a clustering algorithm depends both on the type of data available and on the particular purpose. Sometimes several algorithms are applicable, and a priori arguments may not suffice to narrow down the choice to a single method. In such a situation, it is probably a good idea to run more than one program and to carefully analyze and compare the resulting classifications, making use of their graphical displays. The interpretation of these results must then be based on insight into the meaning of the original data, together with some experience with the algorithms used. It is permissible to try several algorithms on the same data, because cluster analysis is mostly used as a descriptive or exploratory tool, in contrast with statistical tests which are carried out for inferential or confirmatory purposes. That is, we do not wish to prove (or disprove) a preconceived hypothesis; we just want to see what the data are trying to tell us.[16]

22. The last sentence in this passage from Kaufman and Rousseeuw's highly respected text on cluster analysis is particularly germane to the Joint Board's own exercise at using cluster analysis to justify the 135 percent benchmark that it has recommended for a long time. Because the recommended benchmark pre-dates significantly the ex post facto cluster analysis, it has all the markings of a "preconceived hypothesis" that a subsequent analysis has attempted to "prove," exactly what Kaufman and Rousseeuw have admonished us to avoid. Given the uncertainty in any statistical analysis of real-world data, it is remarkable that the ex post cluster analysis could

[16] Kaufman and Rousseeuw, op cit., at 37.

produce a result so supportive of so specific an ex ante benchmark (not 130 percent, not 140 percent, but 135 percent). Unfortunately, as the preceding discussion has shown, the built-in latitude and "flexibility" in the cluster analysis technique can help to deliver such "proof"—even after the fact—of almost any result or hypothesis that one wishes to maintain.

23. Given this background on the merits and shortcomings of cluster analysis as a way of classifying objects or data, it is possible to examine the Joint Board's own cluster analysis exercise to see what it did and, even more importantly, didn't do. To the best of my knowledge, Appendix A of the Recommended Decision contains the greatest amount of detail on the Joint Board's cluster analysis of statewide average cost data.[17] Appendix A consists of a spreadsheet with columns for state names, state-specific cost per loop ("CPL") data, CPL differences (i.e., the difference between the CPL values of contiguous states, where the states are first sorted in ascending order by CPL), and cluster split differences with sub-columns for seven different benchmark values in the range 2.5 to 0.5. The spreadsheet indicates (with the help of asterisks) for which states their CPL differences exceed one or more of the benchmark values for the cluster split difference. The spreadsheet also identifies two clusters of states: the first is an 8-state cluster of allegedly high-cost rural states (including Kentucky, Maine, Alabama, Vermont, Montana, West Virginia, Wyoming, and Mississippi), and the second is a cluster with 43 other jurisdictions

[17] Also see the reasoning in the Recommended Decision, ¶37 and the accompanying footnotes.

(including 41 states, the District of Columbia, and Puerto Rico) representing allegedly low-cost urban states.[18]

24. Unfortunately, the Recommended Decision does not provide much to go by for evaluating how well, or even how, the Joint Board conducted its cluster analysis. The discussion at Recommended Decision, ¶37 is too perfunctory to provide much insight into all the procedures followed. The best I can tell is that the Joint Board may have followed something akin to a hierarchical clustering approach (in particular, the agglomerative method) because the analysis appears to have started with each individual state and to have ended by assigning the 51 jurisdictions among the two final clusters. On the other hand, the manner in which the Joint Board ended up with only two clusters—falling neatly, if simplistically, into the "high-cost, rural"/"low-cost, urban" dichotomy—suggests that the approach could plausibly have been nonhierarchical. The Recommended Decision does not provide a clear roadmap in this matter.

25. The Recommended Decision also provides no details about the clustering algorithm(s) followed or whether the different methods were used in a complementary manner in order to first explore, and then confirm, the number of clusters that could be formed. It provides no indication about the seeds, if any, that were used, the measures of similarity that may have been used, or even whether the

[18] These descriptions or labels are those given by the Joint Board to the jurisdictions in question. See Recommended Decision, ¶37. In the Recommended Decision's Appendix A, the Joint Board's characterization of states like Alaska, North Dakota, New Mexico, Idaho, and South Dakota as "low-cost urban states" alongside the likes of New Jersey, New York, California, Florida, Illinois, and Pennsylvania is certainly questionable.

Joint Board relied on distance measures beyond the obvious CPL difference.[19] It reports no dendrograms (graphical representations that show, for the given data, how successively fewer clusters are derived from prior-stage clusters), nor provides any basis for selecting the number of clusters beyond a somewhat opaque reference to "cluster stability" based on benchmark values for the CPL split difference. In fact, the sensitivity analysis to which the Joint Board refers (Recommended Decision, ¶37) is not explained at any length or detail. For example, it is not at all clear how the finding of observed CPL split differences for certain states being in excess of various benchmark values relates to the formation of clusters, in particular the two clusters the Joint Board chose to report in the Recommended Decision. Finally, the Joint Board makes no attempt to relate its methodology to the standards set for cluster analysis, nor cites any authoritative source for the "technique" it followed. In the ultimate analysis, it is hard to judge the credibility and reliability of the Joint Board's exercise by all the accepted conventions of cluster analysis.

26. In order to explore the robustness of the Joint Board's findings, I conducted several cluster analyses of my own. For this purpose, I used the same statewide average cost data that were reported in Appendix A of the Recommended Decision. I began by applying hierarchical clustering methods—mainly the complete-linkage, single-linkage, and average-linkage algorithms—and relied on the squared Euclidean distance to form clusters. Initially, several small clusters were formed by minimizing the dissimilarities among individual state data points. As I proceeded

[19] When there is only one characteristic or trait for grouping data, such as with statewide average cost, the

with agglomeration, i.e., building fewer but larger clusters from the smaller prior-stage clusters, the formation of the new clusters happened, as expected, at the expense of increasing dissimilarity between data points assigned to different clusters at prior stages.[20] However, by use of dendrograms—graphical representations of the cluster trees—I was able to tentatively identify the number of clusters from the state cost data that were formed before dissimilarity increased substantially. These dendrograms are shown in the Technical Appendix to this declaration.[21]

27. As expected, the dendrograms (particularly, the reduced views) show that the number of clusters identified depends on the clustering algorithm followed. Also, as expected, the number of clusters identified by the single-linkage method was the fewest (3), the number identified by the complete-linkage method was the most (11), and the number identified by the average-linkage method was in between (7).[22] Regarding the last of these results as a good starting point (see fn. 22 below), I examined the corresponding reduced-view dendrogram for a further reduction of

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CPL difference is equivalent to the use of the squared Euclidean distance.

[20] This trade-off between fewer clusters and growing dissimilarity is common in cluster analysis and reflects the cost of oversimplifying by reducing diverse data into a small number of clusters, say, two or three.

[21] Note that there is one complete dendrogram for each hierarchical clustering method used, and an alternate view of that dendrogram with all but its top eliminated. This reduced view makes cluster identification easier. Also, note that the vertical axis of a dendrogram measures the amount of dissimilarity, which clearly grows as the formation of fewer and smaller clusters proceeds. The longer the vertical lines combining prior-stage clusters into new clusters, the greater the dissimilarity that has to be "tolerated" in order to form the new clusters.

[22] See, e.g., Sharma, op cit., Sec 7.9. Sharma explains that the single-linkage method is more likely to suffer from "chaining" (that makes it difficult for an observation, once assigned to a cluster, to be re-assigned to another cluster) and to be affected by outliers and noise. This results in fewer and larger clusters. The complete-linkage method, on the other hand, has precisely the opposite property and tends to resist the effects of outliers and noise, but also produce a larger number of more compact clusters. The average-linkage method appears to represent a feasible compromise between these two opposites.

clusters. Without allowing dissimilarity to grow too much, the 7 clusters tentatively identified at first blush seemed to be reduced to 4. These 4 clusters, tentatively identified by the average-linkage hierarchical method are shown in Table 1 (see Technical Appendix).

28. The break-out in Table 1 resembles the one obtained by the Joint Board prior to the formation of its final two clusters. However, it is important to note that this tentatively-identified set of clusters should not be regarded as anything other than preliminary. A well-known problem with the hierarchical clustering method is that once an observation has been assigned to one cluster, it cannot be re-assigned to any other.[23] This makes it difficult to obtain final clusters with the desired degree of stability.[24] Hence, as noted earlier, a hierarchical clustering method should be used only in an exploratory manner. Non-hierarchical clustering methods should then be used to confirm (or reject) the clusters tentatively identified by the initial hierarchical clustering exercise.

29. Following this dictum, I applied non-hierarchical clustering algorithms (both *k*-means and *k*-medians) to the data, keeping the tentatively identified clusters from the prior step in view. To test for cluster stability, I started with 7 clusters and reduced them one at a time until only 2 were left.[25] During this process, I paid

[23] Sharma, op cit., Sec. 7.9.

[24] Because re-assignment is impossible, a true test of cluster stability is hard to carry out with hierarchical methods. The rigidity of the initial assignment gives an appearance of stability, but that seeming stability cannot be tested.

[25] Cluster stability can be better tested by use of non-hierarchical methods because re-assignment is possible.

particular attention to the 4-cluster solution obtained from the prior step, and followed how observations (states) were re-assigned among clusters as the number of clusters was reduced to 2, as in the Joint Board's final result.[26]

30. As expected, the clusters formed from using the *k*-means and *k*-medians algorithms are different. The clusters formed, with a varying number of clusters, by these two methods are reported in Tables 2 and 3 (see Technical Appendix).

31. Several aspects of the results of non-hierarchical clustering, reported in Tables 2 and 3, are worth noting. First, as expected, re-assignment of states does occur as the number of clusters formed declines. The two methods appear to converge to almost the same clusters in the 4-cluster and 3-cluster solutions. However, when the 2-cluster solution is obtained (to correspond to the Joint Board's stopping point), the memberships of the two clusters are different, and they are each different from the Joint Board's.

32. Second, the *k*-medians approach has only 27 members in the first cluster, as opposed to 35 members from the *k*-means approach. In neither case, however, does the second cluster have as few as 8 members, which was the case with the Joint Board's results. In fact, the second cluster has 16 states/jurisdictions under the *k*-means approach and 24 under the *k*-medians approach, both considerably greater than that in the Joint Board's analysis.

[26] I experimented also with different initial partitioning configurations in order to gauge the sensitivity of the cluster results to the seeds chosen. The clusters became stable as fewer clusters were formed. Also, the clusters remained stable with respect to the different measures of distance used, namely, absolute (or Manhattan) distance and squared Euclidean distance.

33. Third, unlike the Joint Board's finding (or even that from the hierarchical clustering step undertaken earlier), the initial breakouts do not produce single-state clusters with outliers District of Columbia in one and Mississippi in the other. Rather, the District of Columbia is clustered along with at least two other states and Mississippi is clustered along with at least six other states. For all the sensitivity of non-hierarchical clustering algorithms to the choice of initial partitions, this pattern remains quite stable.

34. Fourth, the 4-cluster solution tentatively identified by the earlier hierarchical clustering step appears to be confirmed by the non-hierarchical clustering algorithms as a stable partitioning of the statewide cost data, although the memberships of the four clusters are quite different. With some exceptions, the states that fall into the first cluster of a 4-cluster solution (particularly under the *k*-medians approach) tend mostly to be those that are more densely-populated or industrialized (e.g., District of Columbia, New York, New Jersey, California, Florida, Illinois, Pennsylvania, and Maryland). The middle two clusters contain, by and large, the states that fall in the continuum between industrialized/densely-populated and rural/sparsely-populated,[27] the second cluster being more like the former and the third cluster being more like the latter. Finally, the eight highest-cost states form the fourth cluster, and they are, for the most part, rural or sparsely-populated (in other words, where the economies of density in configuring the loop network are the fewest and the resulting costs per line are the highest).

35. My own exercise attempts to subject the Joint Board's statewide cost data to rigorous and thorough cluster formation and testing. It uses hierarchical and non-hierarchical clustering techniques in the complementary manner recommended by subject matter authorities and tests for cluster stability under a variety of initial assumptions and configurations. While there is no prospect of overcoming completely the property that cluster analysis remains, in the ultimate analysis, a subjective exercise, I have made every effort to ensure that the results are as sensible and stable as possible. In contrast, the Joint Board's sparsely documented cluster analysis appears to have many shortcomings and leaves more questions open than it answers.

36. The most dramatic consequence of my clustering exercise is the bearing the results have on the Joint Board's recommended benchmark. Based on its own exercise, the Joint Board re-affirmed a benchmark of 135 percent. However, if a 2-cluster solution is finally accepted (although, I believe, the 4-cluster solution makes more sense), then the benchmark implied by both the *k*-means and the *k*-medians clustering algorithms is much lower. For example, the *k*-means approach suggests a 35/16 split of the states/jurisdictions. The state with the highest average cost in the first cluster is New Mexico. As Appendix A of the Recommended Decision shows, New Mexico's average cost is $25.70, which is only about 117 percent of the national average cost. Similarly, the *k*-medians approach suggests a 27/24 split of the states/jurisdictions. The state with the highest average cost in the first cluster is

[27] Alaska may be an exception to this general classification heuristic.

Michigan. As Appendix A of the Recommended Decision shows, Michigan's average cost is $23.50, which is only about 107 percent of the national average cost. In either case, the contrast with the Joint Board's choice of a 135 percent benchmark is starkly obvious.

37. Conclusions. In the Recommended Decision, the Joint Board has provided two putative statistical justifications for its earlier decision to adopt a 135 percent benchmark for determining a state's eligibility for federal universal service support. These justifications stem from the Joint Board's conduct of a standard deviation analysis and a cluster analysis. According to the Joint Board, both forms of analysis provide credibility and support for its earlier choice of the 135 percent benchmark and satisfies one of the issues on remand from the 10th Circuit Court of Appeals.

38. My examination of the Joint Board's analyses shows, however, that the so-called justifications are themselves indefensible. Despite its own acknowledgement that statewide average cost data cannot be characterized by the normal distribution, the Joint Board proceeded nonetheless to apply the "two standard deviations from the mean" rule (intended only to apply to normal distributions) for the purpose of identifying "outliers," namely, the extreme 5 percent of the cost data. The Joint Board never explained why that 5 percent cut-off point should suffice for identifying outlier states from the perspective of being "high-cost rural" states. Nor did it explain why that 5 percent cut-off (which includes 2.5 percent in the left tail, i.e., the 2.5 percent of the states with the lowest average costs) is appropriate when the correct rule for excluding 5 percent in each tail of a normal distribution is 1.645

times the standard deviation. Moreover, the Joint Board never explained the plainly anomalous finding that a rule that supposedly identifies the most extreme 2.5 percent of the data in the right tail of the distribution still led the Joint Board to conclude that 15 percent of the states qualified as "outliers" for the purposes of this docket. Given the evident non-normality of the cost data, the Joint Board appears to have forgone the opportunity to use better alternative statistical rules, such as by exploring the empirical distribution created through bootstrapping or other resampling techniques.

39. Similarly, the Joint Board's use of cluster analysis appears, in the ultimate analysis, to make an unconvincing case to support its preconceived 135 percent benchmark. From what it reports in the Recommended Decision, it is difficult to make a thorough evaluation of the Joint Board's cluster analysis. Given the complexity—and obvious subjectivity—of cluster analysis as a data classification or grouping technique, it is unfortunate that the Recommended Decision contains little information with which to evaluate how well, or even how, the Joint Board conducted its cluster analysis. In contrast, my own attempt to conduct a rigorous cluster analysis on the statewide average cost data in Appendix A of the Recommended Decision reveals a very different grouping of the states/jurisdictions. Most significantly, even if a benchmark based on statewide average cost were acceptable (an issue that I do not address here), my analysis shows that the benchmarks implied by cluster analysis should be in the range 107-117 percent, rather than as high as the 135 percent recommended by the Joint Board.

40. In conclusion, there is something ironic—not to mention coincidental—about finding ex post justification for a preconceived hypothesis by use of two completely and utterly unpredictably different methods of data analysis or outlier identification. In that sense, the Recommended Decision may appear to have met the "letter" of the court's remand on the issue of the 135 percent benchmark, but probably not its "spirit."

41. This concludes my declaration.

Technical Appendix

The dendograms shown in the Technical Appendix are graphical representations of the cluster trees that were formed by the different hierarchical clustering techniques employed. The vertical axis shows the "L2 similarity measure" (or, squared Euclidean distance). The horizontal axis arrays the states/jurisdictions, identified by serial numbers. These serial numbers represent the order in which the states/jurisdictions appear in Appendix A of the Recommended Decision. For each complete dendrogram, a dendrogram with a reduced view (all but the tops of the clusters eliminated) is displayed, which makes it easier to tentatively identify the number of clusters to place in a solution.

Figure 1. Dendrogram for Statewide Average Cost in 51 States/Jurisdictions, Using the Average-Linkage Clustering Method

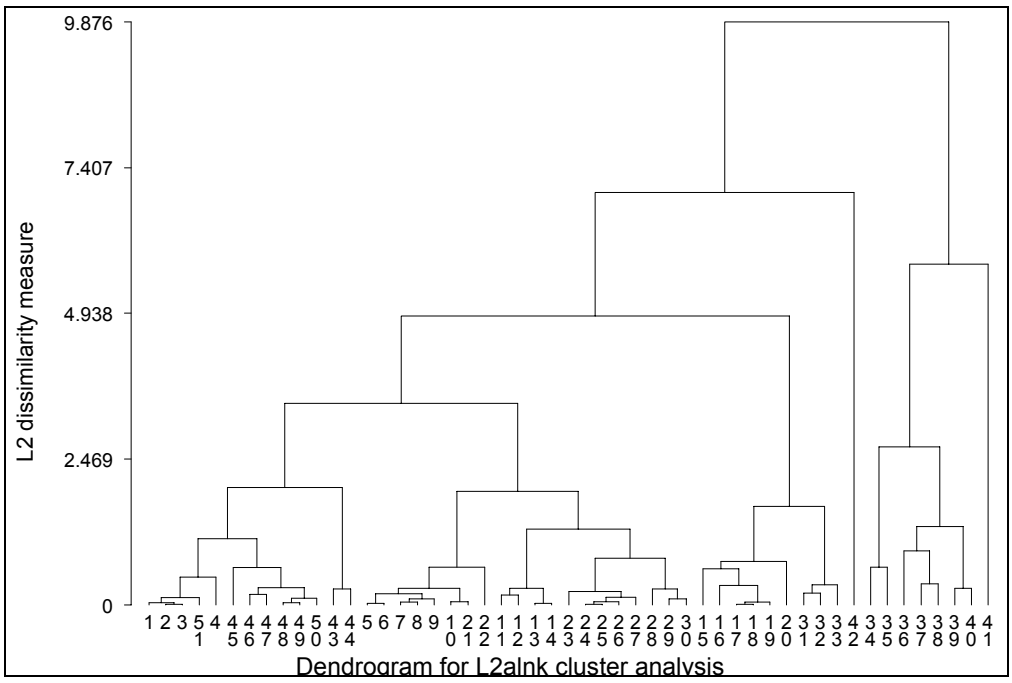

Figure 2. Dendrogram for Statewide Average Cost in 51 States/Jurisdictions, Using the Average-Linkage Clustering Method (Reduced View)

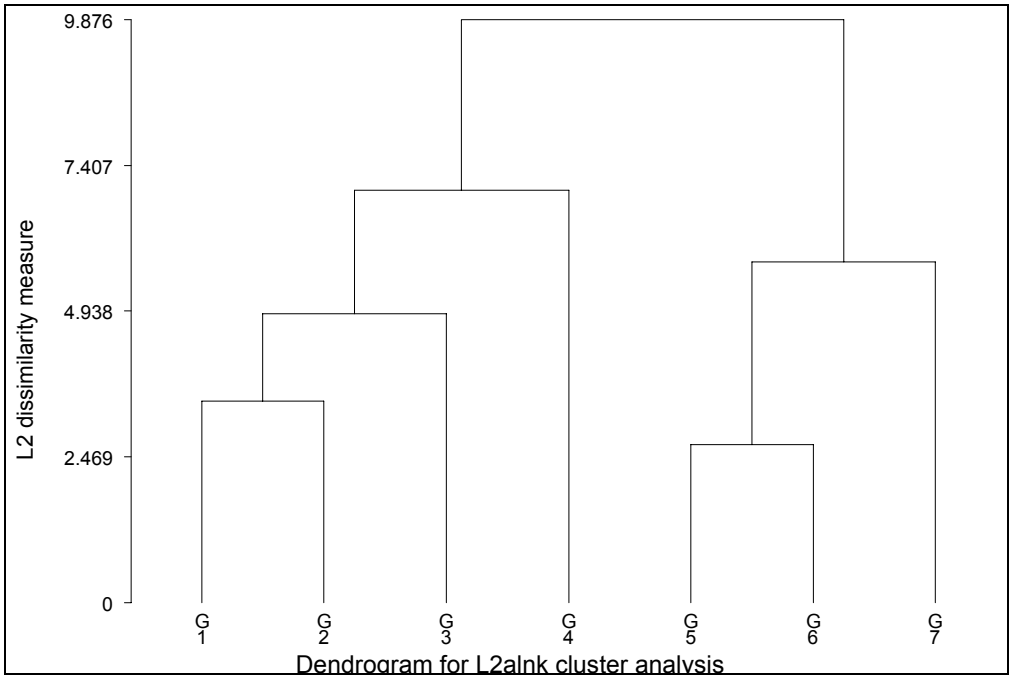

Figure 3. Dendrogram for Statewide Average Cost in 51 States/Jurisdictions, Using the Complete-Linkage Clustering Method

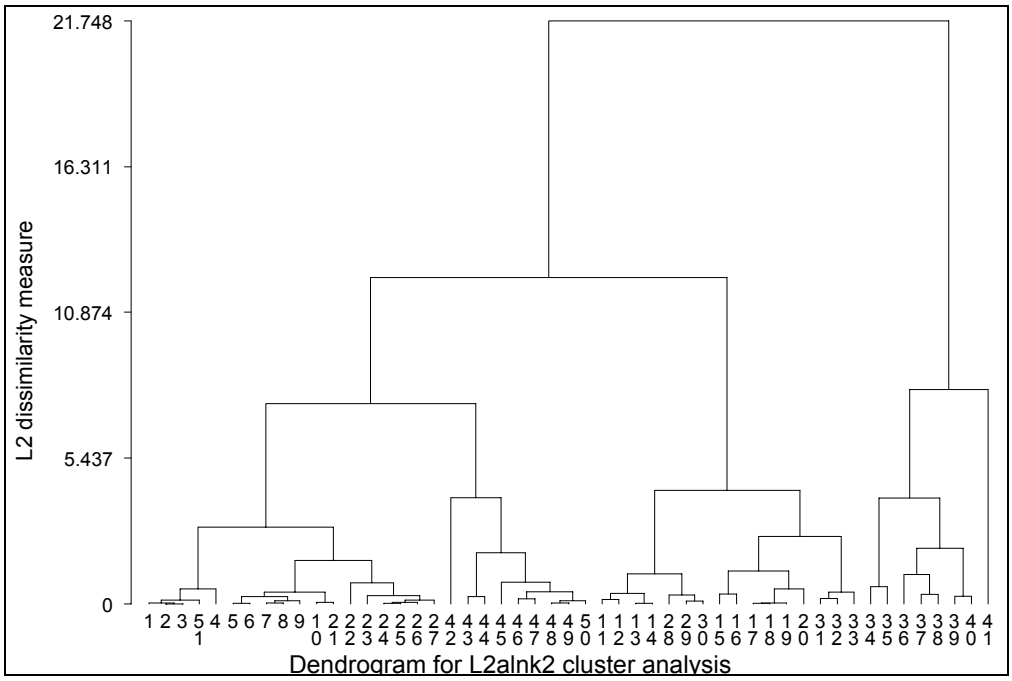

Figure 4. Dendrogram for Statewide Average Cost in 51 States/Jurisdictions, Using the Complete-Linkage Clustering Method (Reduced View)

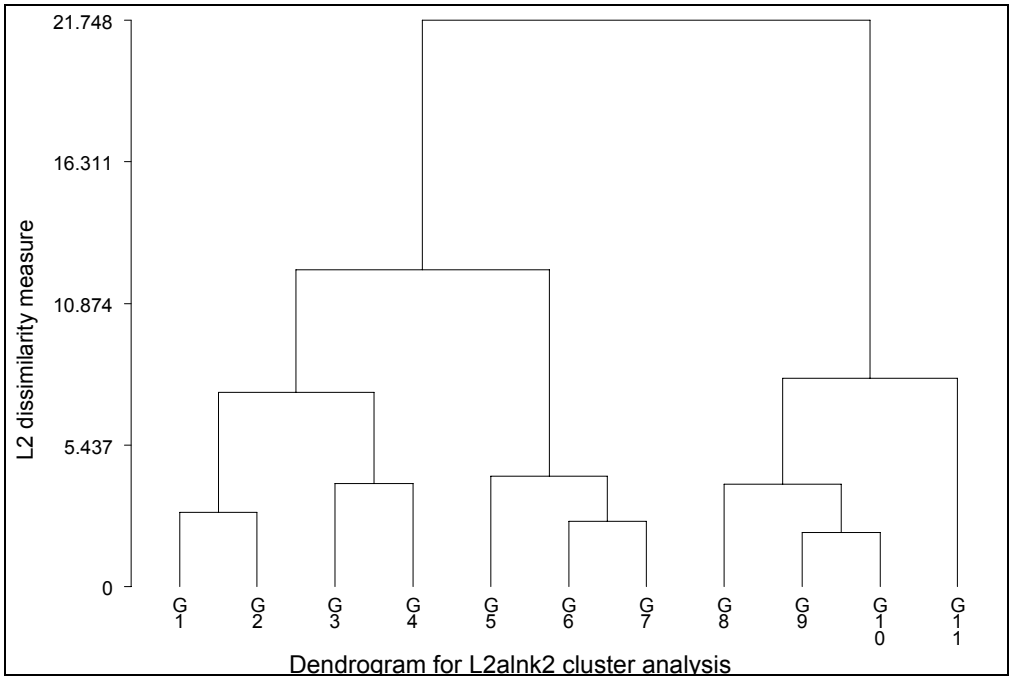

Figure 5. Dendrogram for Statewide Average Cost in 51 States/Jurisdictions, Using the Single-Linkage Clustering Method

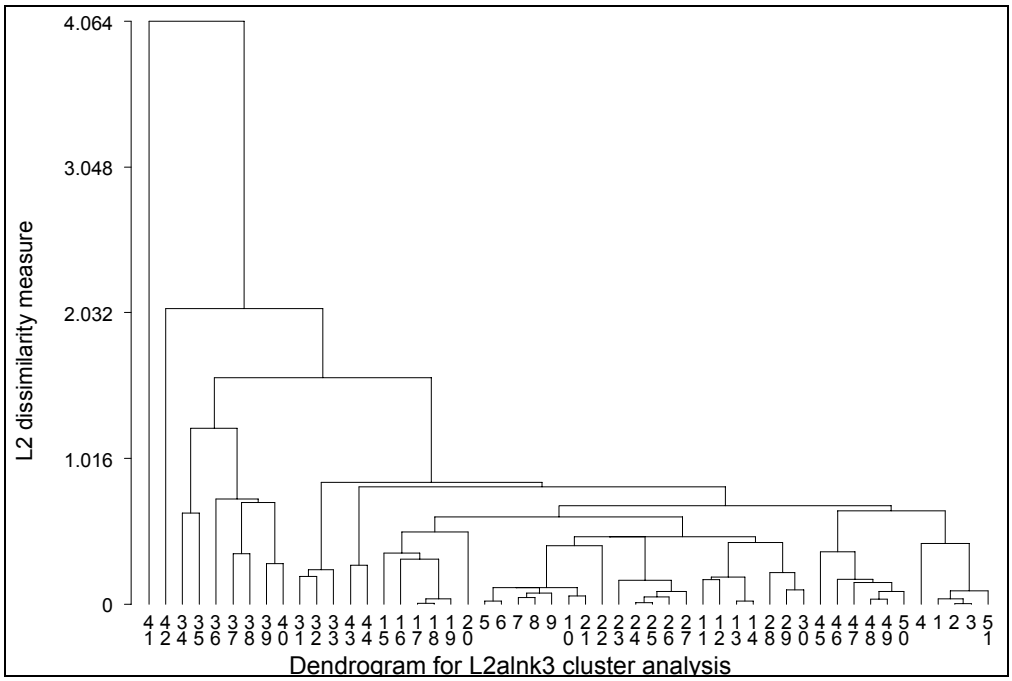

Figure 6. Dendrogram for Statewide Average Cost in 51 States/Jurisdictions, Using the Single-Linkage Clustering Method (Reduced View)

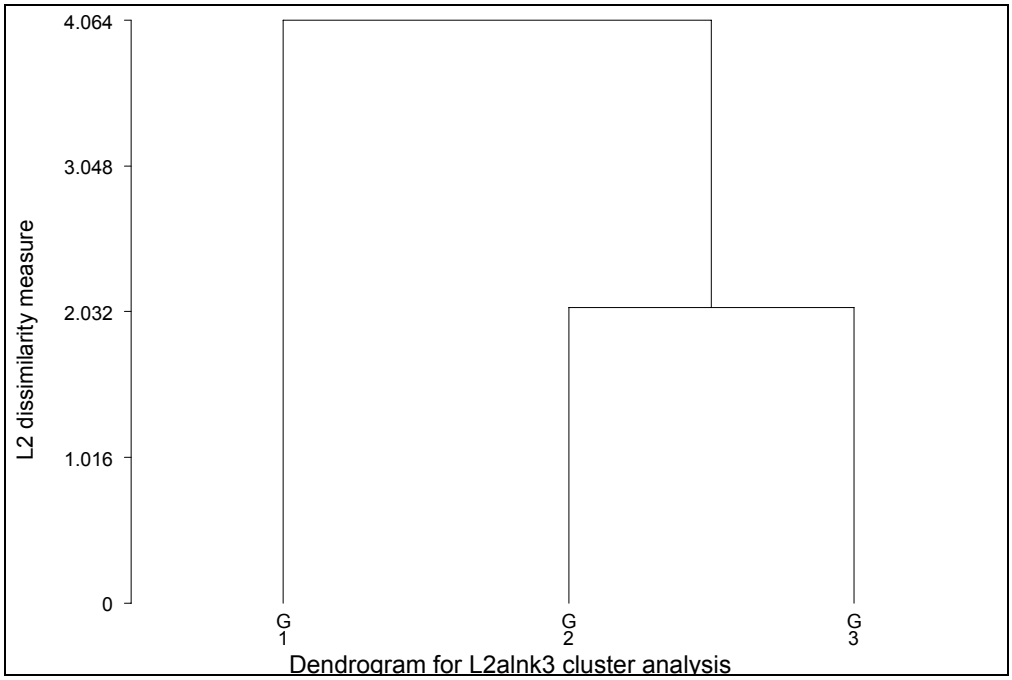

Table 1. Four Clusters (for Statewide Average Cost) Identified by Average-Linkage Hierarchical Clustering Method

Cluster	States/Jurisdictions Identified
1	All other states and jurisdictions (42 in all)
2	District of Columbia
3	Kentucky, Maine, Alabama, Vermont, Montana, West Virginia, Wyoming
4	Mississippi

Table 2. Cluster Solutions and Cluster Memberships Identified by *k*-Means Non-hierarchical Clustering Method

Number of Clusters	Cluster No.	States/Jurisdictions Identified
7	1	District of Columbia, New Jersey, California
	2	Massachusetts, New York, Nevada, Florida, Maryland, Rhode Island
	3	Pennsylvania, Arizona, Hawaii, Illinois, Utah
	4	Virginia, Texas, Alaska, Connecticut, Georgia, Minnesota, Washington, Wisconsin
	5	North Carolina, Colorado, Ohio, Oregon, Michigan, North Dakota, Indiana, Iowa, Kansas, Puerto Rico, Missouri, New Hampshire
	6	New Mexico, South Carolina, Tennessee, Oklahoma, Louisiana, Idaho, South Dakota, Arkansas, Nebraska, Kentucky
	7	Maine, Alabama, Vermont, Montana, West Virginia, Wyoming, Mississippi
6	1	District of Columbia, New Jersey, California
	2	Massachusetts, New York, Nevada, Florida, Maryland, Rhode Island
	3	Pennsylvania, Arizona, Hawaii, Illinois, Utah
	4	Virginia, Texas, Alaska, Connecticut, Georgia, Minnesota, Washington, Wisconsin, North Carolina, Colorado, Ohio, Oregon, Michigan, North Dakota, Indiana, Iowa
	5	Kansas, Puerto Rico, Missouri, New Hampshire, New Mexico, South Carolina, Tennessee, Oklahoma, Louisiana, Idaho, South Dakota, Arkansas, Nebraska
	6	Kentucky, Maine, Alabama, Vermont, Montana, West Virginia, Wyoming, Mississippi

5	1	District of Columbia, New Jersey, California
	2	Massachusetts, New York, Nevada, Florida, Maryland, Rhode Island, Pennsylvania, Arizona, Hawaii, Illinois, Utah
	3	Virginia, Texas, Alaska, Connecticut, Georgia, Minnesota, Washington, Wisconsin, North Carolina, Colorado, Ohio, Oregon, Michigan, North Dakota, Indiana, Iowa
	4	Kansas, Puerto Rico, Missouri, New Hampshire, New Mexico, South Carolina, Tennessee, Oklahoma, Louisiana, Idaho, South Dakota, Arkansas, Nebraska
	5	Kentucky, Maine, Alabama, Vermont, Montana, West Virginia, Wyoming, Mississippi
4	1	District of Columbia, New Jersey, California, Massachusetts, New York, Nevada, Florida, Maryland, Rhode Island
	2	Pennsylvania, Arizona, Hawaii, Illinois, Utah, Virginia, Texas, Alaska, Connecticut, Georgia, Minnesota, Washington, Wisconsin, North Carolina, Colorado, Ohio, Oregon, Michigan, North Dakota
	3	Indiana, Iowa, Kansas, Puerto Rico, Missouri, New Hampshire, New Mexico, South Carolina, Tennessee, Oklahoma, Louisiana, Idaho, South Dakota, Arkansas, Nebraska
	4	Kentucky, Maine, Alabama, Vermont, Montana, West Virginia, Wyoming, Mississippi
3	1	District of Columbia, New Jersey, California, Massachusetts, New York, Nevada, Florida, Maryland, Rhode Island, Pennsylvania, Arizona, Hawaii, Illinois, Utah
	2	Virginia, Texas, Alaska, Connecticut, Georgia, Minnesota, Washington, Wisconsin, North Carolina, Colorado, Ohio, Oregon, Michigan, North Dakota, Indiana, Iowa, Kansas, Puerto Rico, Missouri, New Hampshire, New Mexico, South Carolina, Tennessee, Oklahoma, Louisiana, Idaho
	3	South Dakota, Arkansas, Nebraska, Kentucky, Maine, Alabama, Vermont, Montana, West Virginia, Wyoming, Mississippi

2	1	District of Columbia, New Jersey, California, Massachusetts, New York, Nevada, Florida, Maryland, Rhode Island, Pennsylvania, Arizona, Hawaii, Illinois, Utah, Virginia, Texas, Alaska, Connecticut, Georgia, Minnesota, Washington, Wisconsin, North Carolina, Colorado, Ohio, Oregon, Michigan, North Dakota, Indiana, Iowa, Kansas, Puerto Rico, Missouri, New Hampshire, New Mexico
	2	South Carolina, Tennessee, Oklahoma, Louisiana, Idaho, South Dakota, Arkansas, Nebraska, Kentucky, Maine, Alabama, Vermont, Montana, West Virginia, Wyoming, Mississippi

Table 3. Cluster Solutions and Cluster Memberships Identified by *k*-Medians Non-hierarchical Clustering Method

Number of Clusters	Cluster No.	States/Jurisdictions Identified
7	1	District of Columbia, New Jersey, California, Massachusetts, New York, Nevada, Florida, Maryland, Rhode Island
	2	Pennsylvania
	3	Arizona, Hawaii, Illinois, Utah
	4	Virginia, Texas, Alaska, Connecticut, Georgia, Minnesota, Washington, Wisconsin
	5	North Carolina, Colorado, Ohio, Oregon, Michigan, North Dakota, Indiana, Iowa, Kansas, Puerto Rico
	6	Missouri, New Hampshire, New Mexico, South Carolina, Tennessee, Oklahoma, Louisiana, Idaho, South Dakota, Arkansas, Nebraska
	7	Kentucky, Maine, Alabama, Vermont, Montana, West Virginia, Wyoming, Mississippi
6	1	District of Columbia, New Jersey, California, Massachusetts, New York, Nevada, Florida, Maryland, Rhode Island
	2	Pennsylvania
	3	Arizona, Hawaii, Illinois, Utah
	4	Virginia, Texas, Alaska, Connecticut, Georgia, Minnesota, Washington, Wisconsin, North Carolina, Colorado, Ohio, Oregon, Michigan, North Dakota, Indiana, Iowa

	5	Kansas, Puerto Rico, Missouri, New Hampshire, New Mexico, South Carolina, Tennessee, Oklahoma, Louisiana, Idaho, South Dakota, Arkansas, Nebraska
	6	Kentucky, Maine, Alabama, Vermont, Montana, West Virginia, Wyoming, Mississippi
5	1	District of Columbia, New Jersey, California, Massachusetts, New York, Nevada, Florida, Maryland, Rhode Island
	2	Pennsylvania, Arizona, Hawaii, Illinois, Utah
	3	Virginia, Texas, Alaska, Connecticut, Georgia, Minnesota, Washington, Wisconsin, North Carolina, Colorado, Ohio, Oregon, Michigan, North Dakota, Indiana, Iowa
	4	Kansas, Puerto Rico, Missouri, New Hampshire, New Mexico, South Carolina, Tennessee, Oklahoma, Louisiana, Idaho, South Dakota, Arkansas, Nebraska
	5	Kentucky, Maine, Alabama, Vermont, Montana, West Virginia, Wyoming, Mississippi
4	1	District of Columbia, New Jersey, California, Massachusetts, New York, Nevada, Florida, Maryland, Rhode Island, Pennsylvania, Arizona, Hawaii, Illinois
	2	Utah, Virginia, Texas, Alaska, Connecticut, Georgia, Minnesota, Washington, Wisconsin, North Carolina, Colorado, Ohio, Oregon, Michigan, North Dakota
	3	Indiana, Iowa, Kansas, Puerto Rico, Missouri, New Hampshire, New Mexico, South Carolina, Tennessee, Oklahoma, Louisiana, Idaho, South Dakota, Arkansas, Nebraska
	4	Kentucky, Maine, Alabama, Vermont, Montana, West Virginia, Wyoming, Mississippi
3	1	District of Columbia, New Jersey, California, Massachusetts, New York, Nevada, Florida, Maryland, Rhode Island, Pennsylvania, Arizona, Hawaii, Illinois, Utah
	2	Virginia, Texas, Alaska, Connecticut, Georgia, Minnesota, Washington, Wisconsin, North Carolina, Colorado, Ohio, Oregon, Michigan, North Dakota, Indiana, Iowa, Kansas, Puerto Rico, Missouri, New Hampshire, New Mexico, South Carolina, Tennessee, Oklahoma, Louisiana, Idaho
	3	South Dakota, Arkansas, Nebraska, Kentucky, Maine, Alabama, Vermont, Montana, West Virginia, Wyoming, Mississippi

2	1	District of Columbia, New Jersey, California, Massachusetts, New York, Nevada, Florida, Maryland, Rhode Island, Pennsylvania, Arizona, Hawaii, Illinois, Utah, Virginia, Texas, Alaska, Connecticut, Georgia, Minnesota, Washington, Wisconsin, North Carolina, Colorado, Ohio, Oregon, Michigan
	2	North Dakota, Indiana, Iowa, Kansas, Puerto Rico, Missouri, New Hampshire, New Mexico, South Carolina, Tennessee, Oklahoma, Louisiana, Idaho, South Dakota, Arkansas, Nebraska, Kentucky, Maine, Alabama, Vermont, Montana, West Virginia, Wyoming, Mississippi

CERTIFICATE OF SERVICE

I, Richard Grozier, do hereby certify that I have caused the foregoing **COMMENTS OF QWEST COMMUNICATIONS INTERNATIONAL INC. IN RESPONSE TO THE JOINT BOARD'S RECOMMENDED DECISION** to be 1) filed with the FCC via its Electronic Comment Filing System, and 2) served via email on the parties listed below.

Richard Grozier
Richard Grozier

Sheryl Todd stodd@fcc.gov

Qualex International Inc. qualexint@aol.com

December 20, 2002